

PRINTERS AND NOTEBOOK COMPUTERS

In this chapter, you will learn:

- ◆ How printers, including laser printers and ink-jet photo-quality printers, work
- ◆ How to support and troubleshoot printers
- ◆ About the special needs of supporting printers on a network
- ◆ How to upgrade memory on a notebook
- ◆ How Windows 98 supports notebooks and about notebook support new to Windows 2000
- ◆ About power management features of notebooks
- ◆ How to support PC Cards for notebooks

A PC technician's job requires familiarity with a wide range of technologies: not just computers, but networks, telecommunications, data formatting, and so on. Technicians are often called on to support printers and notebook computers. This chapter first covers supporting printers and then addresses the special needs of notebook computers.

PRINTERS

A⁺CORE 5.1 Chapter 8 covered the fundamentals of supporting printers. This chapter provides more detail, covering how printers work and how to support them, including those on a network. Printers connect to a PC by way of a parallel port, serial port, USB port or a wireless connection using an infrared port. A PC can then share its printer with others on a network.

How Printers Work

A⁺CORE 5.1 This section focuses on laser, ink jet, and dot-matrix printers. You will examine how these printers work and how to maintain them.

Laser Printers

Laser printers are a type of electrophotographic printers and range from small, personal desktop models to large network printers capable of printing handling large volumes continuously. Figure 18-1 shows an example of a typical laser printer for a desktop computer system, the Hewlett-Packard LaserJet 4050.



Figure 18-1 The HP LaserJet 4050 desktop laser printer

Laser printers require the interaction of mechanical, electrical, and optical technologies to work. Understanding how they work will help you support and service them. It also explains why the safety precautions stated in laser printer user manuals are necessary.

How a Laser Printer Works Laser printers work by placing toner on an electrically charged rotating drum and then depositing the toner on paper as the paper moves through the system at the same speed the drum is turning. Figure 18-2 shows the six steps of laser printing. The first four use the printer components that undergo the most wear. They are

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contained within the removable cartridge to increase the life of the printer. The last two steps are performed outside the cartridge. Follow the steps of laser printing below while you refer to Figure 18-2:

1. **Cleaning.** The drum is cleaned of any residual toner and electrical charge.
2. **Conditioning.** The drum is conditioned to contain a high electrical charge.
3. **Writing.** A laser beam discharges the high charge down to a lower charge, only in those places where toner is to go.
4. **Developing.** Toner is placed onto the drum where the charge has been reduced.
5. **Transferring.** A strong electrical charge draws the toner off the drum onto the paper. This is the first step that takes place outside the cartridge.
6. **Fusing.** Heat and pressure fuse the toner to the paper.

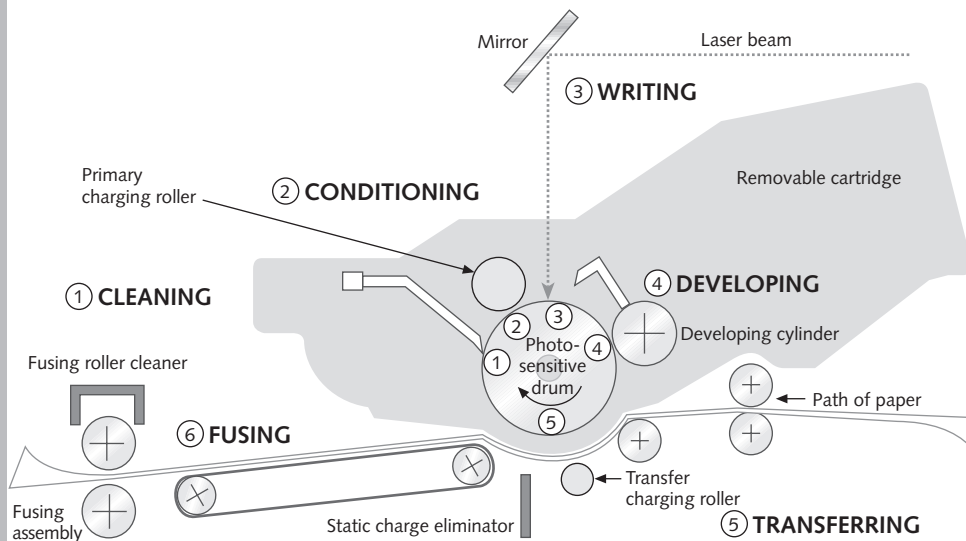


Figure 18-2 The six progressive steps of laser printing

Note that Figure 18-2 shows only a cross-section of the drum, mechanisms, and paper. As you visualize the process, remember that the drum is as wide as a sheet of paper. The mirror, blades, and rollers in the drawing are also as wide as paper. First note the location of the removable cartridge in the drawing, the photosensitive drum inside the cartridge turning in a clockwise direction, and the path of the paper, which moves from right to left.

Step 1: Cleaning. Figure 18-3 shows a clear view of the cleaning step. First a sweeper strip cleans the drum of any residual toner, which is swept away from the drum by a sweeping blade. A cleaning blade completes the physical cleaning of the drum. Next the drum is cleaned of any electrical charge by erase lamps (located in the hinged top cover of the printer), which light the surface of the drum to neutralize any electrical charge left on the drum.

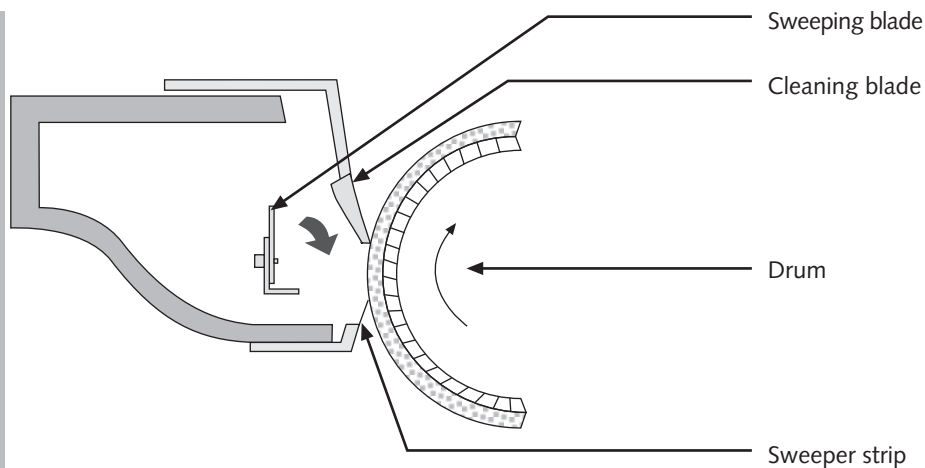
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Figure 18-3 The cleaning step cleans the drum of toner and electrical charge

Step 2: Conditioning. The conditioning step puts a uniform electrical charge of -600 V on the drum. The charge is put there by a primary charging roller or primary corona, which is charged by a high-voltage power supply assembly. The primary charging roller in Figure 18-2 is inside the toner cartridge, and regulates the charge on the drum, ensuring that it is a uniform -600 V .

Step 3: Writing. In the writing step, the uniform charge that was applied in Step 2 is discharged only where you want the printer to print. This is done by controlling mirrors to reflect laser beams onto the drum in a pattern that recreates the image desired. This is the first step in which data from the computer must be transmitted to the printer. Figure 18-4 shows the process: Data from the PC is received by the formatter (1) and passed on to the DC controller (2) that controls the laser unit (3). The laser beam is initiated and directed toward the octagonal mirror called the **scanning mirror**. The scanning mirror (4) is turned by the scanning motor in a clockwise direction. There are eight mirrors on the eight sides of the scanning mirror. As the mirror turns, the laser beam is directed in a sweeping motion that can cover the entire length of the drum. The laser beam is reflected off the scanning mirror, focused by the focusing lens (5), and sent on to the mirror (6), which is also shown in Figure 18-2. The mirror deflects the laser beam to a slit in the removable cartridge and on to the drum (7).

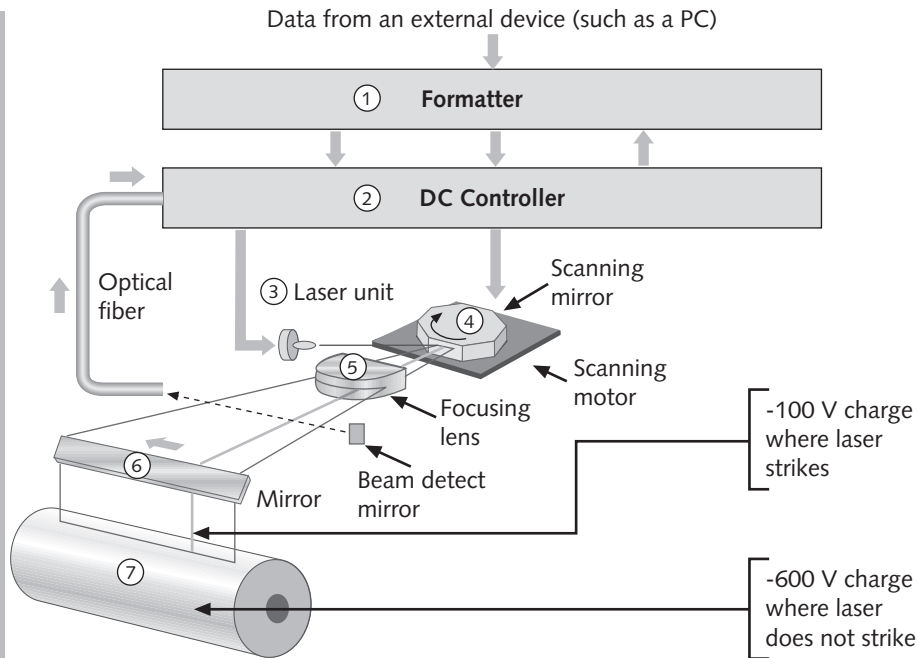


Figure 18-4 The writing step, done by an invisible laser beam, mirrors, and motors, causes a discharge on the drum where the image will be recaptured

The speed of the motor turning the drum and the speed of the scanning motor turning the scanning mirror are synchronized so that the laser beam completes one pass, or scanline, across the drum and returns to the beginning of the drum (right side of the drum in Figure 18-4) to begin a new pass until it completes the correct number of passes for each inch of the drum circumference. For example, for a 300 dots per inch (dpi) printer, the beam makes 300 passes for every one inch of the drum circumference. The laser beam is turned on and off continually as it makes a single pass down the length of the drum, so that dots are written along the drum on every pass. For a 300 dpi printer, 300 dots are written along the drum for every inch of linear pass. The 300 dots per inch down this single pass, along with 300 passes per inch of drum circumference, together accomplish the resolution of 300 X 300 dots per square inch of many desktop laser printers.



A laser printer can produce better quality printouts than dot matrix printers, even when printing at the same dpi, because it can vary the size of the dots it prints, creating a sharp, clear image. HP calls this technology of varying the size of dots **RET (resolution enhancement technology)**.

In a laser printer, where the laser beam strikes the surface of the drum, the drum discharges from its conditioned charge of -600 V down to -100 V where toner will be placed on the drum. Toner does not stick to the highly charged areas of the drum.

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Just as the scanning laser beam is synchronized to the rotating drum, the data output is synchronized to the scanning beam. Before the beam begins moving across the scanline of the drum, the **beam detect mirror** detects the laser beam by reflecting it to an optical fiber. The light travels along the optical fiber to the DC controller, where it is converted to an electrical signal that synchronizes the data output. The signal is also used to diagnose problems with the laser or scanning motor.

The laser beam has written an image to the drum surface as a -100 V charge. The -100 V charge on this image area will be used in the developing stage to transmit toner to the drum surface.

Step 4: Developing. Figure 18-5 shows the developing step, in which toner is applied by the developing cylinder to the discharged (-100 V) areas of the drum. Toner transfers from the cylinder to the drum as the two rotate very close together. The cylinder is coated with a layer of toner, made of black resin bonded to iron, which is similar to the toner used in photocopy machines. The toner is held on the cylinder surface by its attraction to a magnet inside the cylinder. (A **toner cavity** keeps the cylinder supplied with toner.) A **control blade** prevents too much toner from sticking to the cylinder surface. The toner on the cylinder surface takes on a negative charge (between -200 V and -500 V) because the surface is connected to a DC power supply called the DC bias.

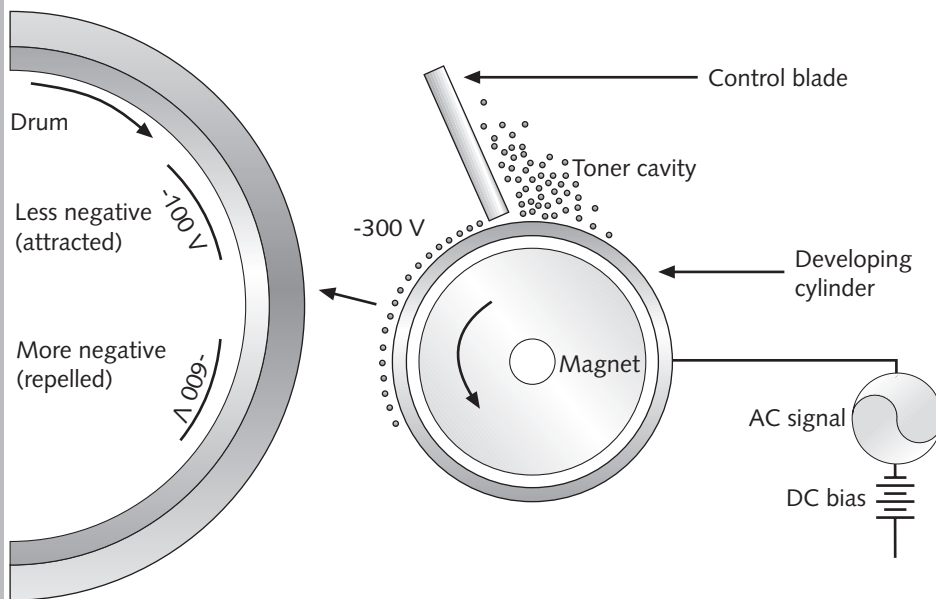


Figure 18-5 In the developing step, charged toner is deposited onto the drum surface

The negatively charged toner is more negative than the -100 V on the drum surface but less negative than the -600 V surface. This means the toner is attracted to the -100 V area of the drum surface (the -100 V area is positive *relative to* the toner). The toner is repelled from the

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–600V part of the drum surface, which is negative *relative to* the toner. The result is that toner sticks to the drum where the laser beam has hit and is repelled from the area where the laser beam has not hit.

You can adjust printer density manually at the printer or through software controlling the printer. With laser printers, when you adjust print density, you are adjusting the DC bias charge on the developing cylinder, which controls the amount of toner attracted to the cylinder, which, in turn, results in a change in print density.

Step 5: Transferring. In the transferring step, the transfer charging roller or transfer corona (shown in Figure 18-2) produces a positive charge on the paper that pulls the toner from the drum onto the paper when it is passed between the transfer charging roller and the drum. The static charge eliminator (refer again to Figure 18-2) weakens the positive charge on the paper and the negative charge on the drum so that the paper does not adhere to the drum—which it would otherwise do because of the difference in charge between the two. The stiffness of the paper and the small radius of the drum also help the paper move away from the drum and toward the fusing assembly. Very thin paper can wrap around the drum, which is why printer manuals usually instruct you to use only paper designated for laser printers.

Step 6: Fusing. The fusing step causes the toner to bond with the paper. Up to this point, the toner is merely sitting on the paper. The fusing rollers apply both pressure and heat to the paper. The toner melts, and the rollers press the toner into the paper. The temperature of the rollers is monitored by the printer. If the temperature exceeds an allowed maximum value (410° F for some printers), the printer shuts down.

The previous steps describe how a black and white printer works. Color laser printers work in a similar way except that the writing process repeats four times, one for each toner color of cyan, magenta, yellow, and black. Then the paper passes to the fusing stage where the fuser bonds all toner to the paper and aids in blending the four tones to form specific colors.

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Supporting Laser Printers All of the major mechanical printer components that normally create problems are conveniently contained within the replaceable toner cartridge. In most cases, the solution to poor quality printing is to replace this cartridge. Follow these general guidelines:

- If the print is faded, smeared, wavy, speckled, or streaked, the toner may be low. Remove the toner cartridge and gently rock it from side to side to redistribute the toner. Replace the cartridge. If this solves the problem, plan to replace the toner cartridge soon.
- If this doesn't solve the problem, try replacing the toner cartridge.
- EconoMode (a mode that uses less toner) may be on; turn it off.
- On some laser printers, you can clean the mirror. Check the user guide for directions.
- A single sheet of paper may be defective. Try new paper.
- The paper may not be of high enough quality. Only use paper recommended for use in a laser printer.

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- Try a different brand of paper.
- Clean the inside of the printer with a dry, lint-free cloth. Don't touch the transfer roller.
- If the transfer roller is dirty, the problem will probably correct itself after printing several sheets. If not, then take the printer to an authorized service center.

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Ink-Jet Printers

Ink-jet printers don't normally provide the quality resolution of laser printers, but are popular because they are small and can print color inexpensively. Ink-jet printers tend to smudge on inexpensive paper, and they are slower than laser printers. The quality of the paper used with ink-jet printers significantly affects the quality of printed output. Only use paper designed for an ink-jet printer, and to get the best results, use a high-grade paper. Figure 18-6 shows one example of an ink-jet printer.



Figure 18-6 An example of an ink-jet printer

How an Ink-Jet Printer Works An ink-jet printer resembles a dot-matrix printer in several ways. Both printers use a print head that moves across the paper, creating one line of text with each pass. Also, both types of printer put ink on the paper using a matrix of small dots, although ink-jet printers use much smaller dots than do dot-matrix printers.

Different types of ink jet printers form their droplets of ink in different ways. Printer manufacturers use several technologies, but the most popular is the bubble jet. Bubble jet printers use tubes of ink that have tiny resistors near the end of each tube. These resistors heat up and cause the ink to boil. Then, a tiny air bubble of ionized ink (which means that it has an electrical charge) is ejected onto the paper. A typical bubble jet print head has 64 or 128 tiny nozzles, and all can fire a droplet simultaneously. Plates carrying a magnetic charge direct the path of ink onto the paper to form shapes.

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Ink jet printers include one or more cartridges of ink. When purchasing an ink jet printer, look for the kind that uses two separate cartridges, one for black ink and one for three-color printing. If an ink-jet printer does not have a black ink cartridge, then it produces black by combining all colors of ink to produce a dull black. Having a separate cartridge for black ink means that it prints a true black and, more importantly, does not use the more expensive colored ink. You can replace the black cartridge without also replacing the colored ink cartridge.

Figure 18-7 shows the two ink cartridges for the Hewlett-Packard DeskJet 712C. The cartridge on the left contains red, blue, and yellow ink (official names are magenta, cyan, and yellow), and the cartridge on the right contains black ink. The print head assemblage in the figure is located in the center position because the top cover has been lifted. Normally when the printer is not in use, the head assemblage sits to the far right of the printing area. This is called the home position and helps protect the ink in the cartridges from drying out.

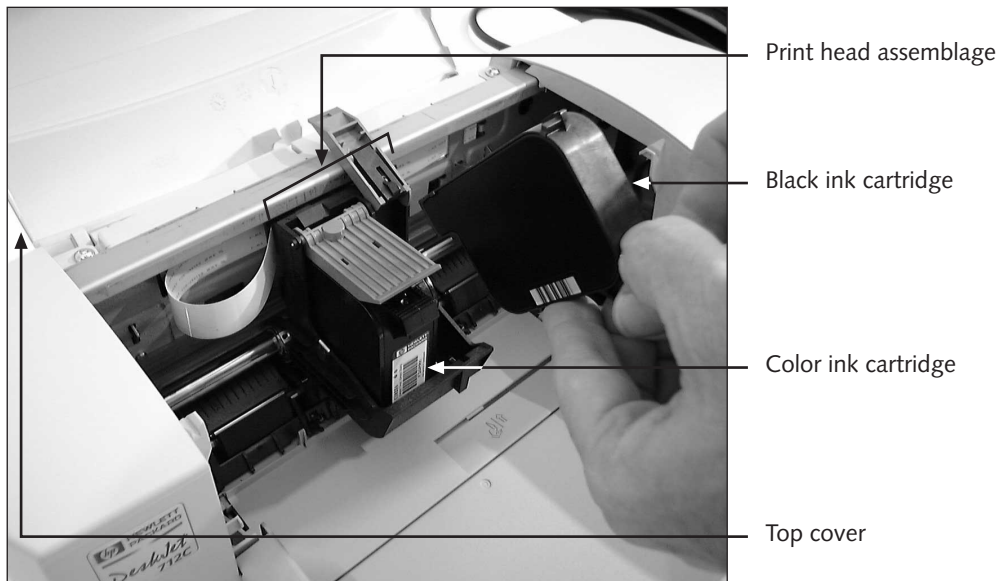


Figure 18-7 The ink-jet cartridges of an ink-jet printer

Photo-Quality Ink-Jet Printers A new generation of ink-jet printers has emerged that can give photo-quality results, especially when used with photo-quality paper. Until this new technology, increasing the quality of an ink-jet printer meant increasing the dpi (dots per inch). Earlier ink-jet printers used 300 dpi, but ink-jet printers today can use as many as 1400 dpi. Increasing the dpi has its drawbacks. Doing so increases the amount of data sent to the printer for a single page, and all those dots of ink on the page can produce a wet page. An improved technology that gives photo-quality results mixes different colors of ink to produce a new color that then makes a single dot. Hewlett-Packard calls this PhotoREt II color technology. HP mixes as many as 16 drops of ink to produce a single dot of color on the page, producing up to 30 times as many shades of color as conventional ink-jet printing does.

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The results are dramatic, and the cost of an ink-jet printer using photo-quality technology is not significantly different from that of a standard printer.

Supporting an Ink-Jet Printer Sometimes dust or dirt gets down into the print head assemblage, which can cause streaks or lines on the printed page. See the printer guide to see how to clean the print cartridges and their cradles.

Correcting Missing Lines or Dots on the Printed Page The ink nozzles on an ink-jet cartridge occasionally dry out, especially when the printer sits unused for a long time. Symptoms of this are missing lines or dots on the printed page. With older ink-jet printers, you had to clean the ink-jet nozzles manually, but now newer printers often let you clean the nozzles automatically, using software or buttons on the front panel of the printer. This section describes how to use supporting software to clean the nozzles on one ink-jet printer. For more information about how to clean the nozzles on your printer, see the printer documentation.

Using Software to Clean Ink-Jet Nozzles For the HP 710C series of printers, you can use the software that accompanies the printer to clean the ink-jet nozzles automatically. When the printer software was installed, it placed a printer toolbox icon on the desktop and added several tabs to the printer Properties dialog box. Use a tab on the printer Properties dialog box to clean the ink-jet nozzles. Here is what you do:

1. Click **Start**, point to **Settings**, and click **Printers**. The Printers window opens. Right-click the ink-jet printer icon and select **Properties** from the shortcut menu.
2. Click the **Services** tab. Figure 18-8 shows the list of services available for this printer.
3. Click **Clean the print cartridges** to clean the ink-jet nozzles automatically.
4. A test page prints. If the page prints sharply with no missing dots or lines, then you are finished. If the page does not print correctly, perform the auto-clean again.
5. You might need to perform the auto-clean procedure six or seven times to completely clean the nozzles. If the problem persists, don't attempt to manually clean the nozzles—contact the manufacturer or vendor for service.

Correcting Ink Streaks Follow the manufacturer's directions to clean the print cartridge assemblage. Use clean distilled water and cotton swabs to clean the cartridge cradle and the face and edges of the print cartridge, being careful not to touch the nozzle plate. To prevent the ink-jet nozzles from drying out, don't leave the print cartridges out of their cradle for longer than 30 minutes.

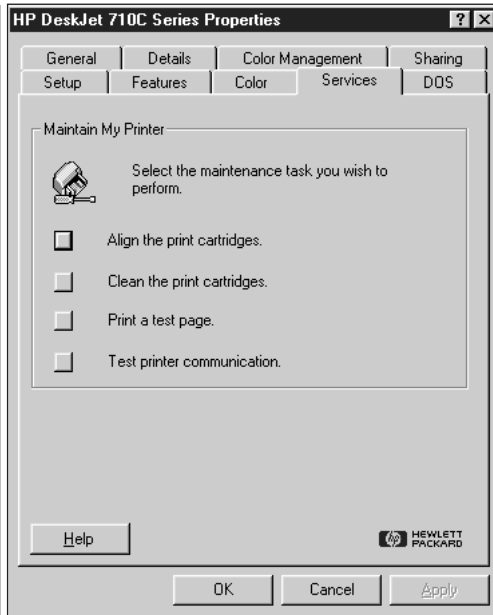
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Figure 18-8 Use the Services tab under the printer Properties box to auto-clean the ink-jet nozzles

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Dot-Matrix Printers

Dot-matrix printers are less expensive than other types of printers, but they don't give nearly the print quality. The one reason you still see so many around is that they are impact printers and can print multicopy documents. A dot-matrix printer has a print head that moves across the width of the paper using pins to print a matrix of dots on the page. The pins shoot against a cloth ribbon, which hits the paper, depositing the ink. The ribbon provides both the ink for printing and the lubrication for the pin heads.

Occasionally, you should replace the ribbon of a dot matrix printer. Although the print head can wear out, replacing it is probably not cost-effective because it costs almost as much as the printer itself. If the print head fails, buy a new printer. Overheating can damage a print head (see Figure 18-9). Keep the print head as cool as possible so that it will last longer. Keep the printer in a cool, well-ventilated area and don't use it to print more than 50 to 75 pages without allowing the head to cool down.

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Figure 18-9 Keep the print head of a dot-matrix printer as cool as possible so that it will last longer

Supporting Printers

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This section briefly introduces how Windows 9x prints, and then discusses how to improve printer performance and troubleshoot printer problems.

Printing Using Windows 9x

Windows 9x manages print jobs in one of three ways:

- For Windows applications using a non-PostScript printer, the print job data is converted to **enhanced metafile format (EMF)**. This format embeds print commands in the data to help speed up printing.
- For Windows applications using a PostScript printer, the print job data is converted to the PostScript language. (Recall that a PostScript printer is a printer that uses a special language for data communication called PostScript.)
- For DOS applications, data is not converted, but sent to the printer as is (this is called raw data).

When Windows 9x receives a print job from an application, it places the job in a queue and prints from the queue, so that the application is released from the printing process as soon as possible. Several print jobs can accumulate in the queue, which you can view in the Printer window. This process of queue printing jobs is called **spooling**. (The word “spool” is an acronym for simultaneous peripheral operations on line.) Most printing from Windows 9x uses EMF spooling.

A⁺ OS 2.4 If the parallel port, printer cable, and printer all support bidirectional communication, the printer can communicate with Windows. For example, Windows 9x can ask the printer how much printer memory is available and what fonts are installed. The printer can send messages to the OS such as an out-of-paper or paper jam message. Bidirectional communication for parallel ports and parallel data cables was discussed in Chapter 9.

A⁺ OS 3.2 Improving Printer Performance

The speed of a small, desktop printer depends on the speed of the computer and the printer itself. Laser printers are rated by two speed properties: the time it takes to print the first page measured in seconds and the print speed measured in pages per minute. If the printer is very slow, upgrading the computer's memory or the CPU can help. Printer speed can also be improved by lowering the printer resolution and the print quality.

To speed up a laser printer, besides lowering the printer resolution and the print quality (which lowers the RET settings), you can try adding more memory to the printer.

If the bottom portion of a page on a laser printer does not print, the problem is that either the PC or the printer needs more memory. Upgrading memory on either the PC or the printer might solve the problem.

The quality of paper determines the final print quality, especially with ink-jet printers. In general, the better the quality of the paper used with an ink-jet printer, the better the print quality. Do not use less than 20-lb paper in any type of printer, unless the printer documentation specifically says that a lower weight is satisfactory.

Troubleshooting Guidelines for Printers

When resolving printer problems, begin by finding the problem. It may be with the printer, the PC hardware or OS, the application using the printer, the printer cable, or, in the case of a printer installed on a network, the network. This section first addresses how to isolate the problem and then discusses troubleshooting each of the possible sources of the problem. Problems with printers on a network are covered later in the chapter. Follow the steps in Figure 18-10 to isolate the problem to one of the following areas:

- The application attempting to use the printer
- The OS and printer drivers
- Connectivity between the PC and the printer
- The printer

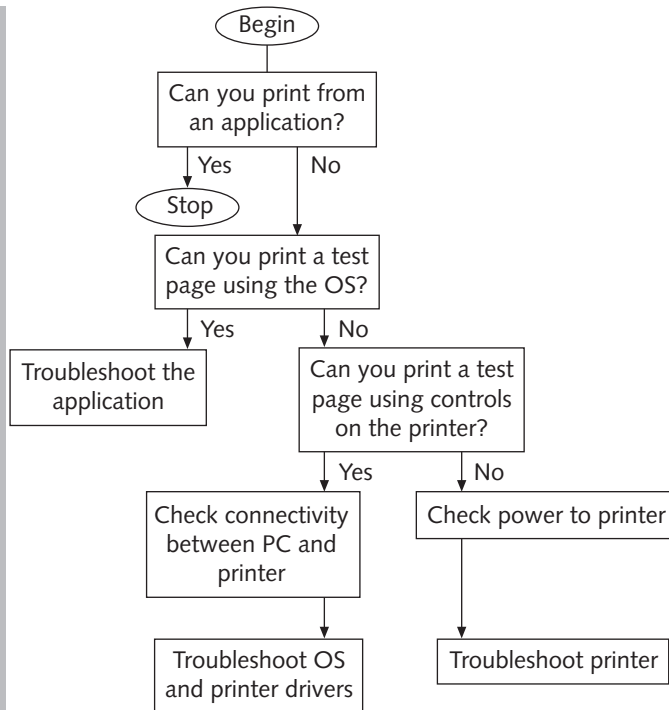
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Figure 18-10 How to isolate a printer problem

Operating System Test Page If you can print a test page from the operating system, you have eliminated every possible source of the problem except the applications software that is trying to print.

1. To print a test page using the OS, click **Start**, point to **Settings**, and click **Printers**. The Printers window opens.
2. Right-click the icon for the printer you are testing. The printer Properties dialog box opens, as in Figure 18-11. Click **Print Test Page**.
3. This test page is different from the one that prints from the printer self-test. This test page contains a list of driver files that the OS is using to communicate with the printer, and the port and the name of the driver the OS is using.

If you cannot print successfully, Windows 9x will automatically launch its troubleshooting tool to help you troubleshoot the problem. It will make suggestions and ask questions to help discover the solution to the problem.

If the operating system test page printed correctly, turn to the applications software and begin troubleshooting there.

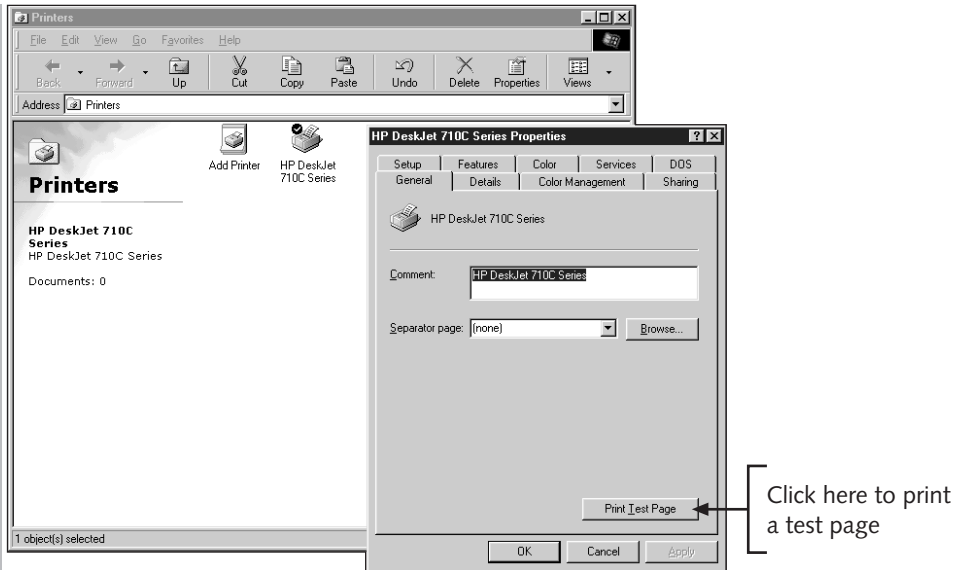
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Figure 18-11 If a **Print Test Page** command is successful, then the OS, device drivers, communications, and the printer are all working properly

Problems with the Printer To eliminate the printer as the problem, print a test page at the printer. If this test page prints correctly, it confirms that the printer is working correctly.



When troubleshooting problems with printer drivers, check the web site of the printer manufacturer to download the latest driver. Also, look for troubleshooting suggestions in the site's FAQs. You might also be able to get help by e-mailing technical support.

Printer Self-Test Page Follow these steps to print a self-test page.

1. For directions to print a self-test page, see the user guide for the printer. One example, the HP LaserJet 5L, prints a test page if you hold down the button on the front panel until the front panel lights begin to blink.
2. A printer test page generally prints some text and some graphics and prints information about the printer such as the printer resolution and how much memory is installed.
3. Verify that the information on the test page is correct. For example, if you know that the printer should have 2 MB of on-board printer memory, but it only reports 1 MB, then there is a problem with memory.

A⁺ OS 3.2 If the test page does not print, or prints incorrectly (for example, it has missing dots or smudged streaks through the page), troubleshoot the printer until you can successfully print a good test page:

- Turn the printer off and disconnect it from the PC. Turn the printer back on and try to print another self-test page.
- Does the printer have paper? Is the paper installed correctly? Is there a paper jam?
- Reset the printer.
- For a laser printer, check that a toner cartridge is installed. For an ink jet printer, check that ink cartridges are installed.
- Check that power is getting to the printer.
- Try another power cable.

For some laser printers, if the printer does not have enough memory to hold the entire page, an error occurs. For others, only a part of the page prints.

Some HP LaserJet printers that don't have a control panel on the front of the printer signal errors by a flashing amber light. For some HP LaserJet printers that have a control panel, the error message for low memory is "20 Mem Overflow." The solution is to install more memory or only print simple pages with few graphics.

Print a self-test page to verify how much memory is installed. Check the printer guide to determine how much memory the printer can support and what kind of memory to buy.

A⁺ CORE 5.2 **Problem with the Printer Cable** If the printer self-test worked, but the OS printer test did not work, the problem might be with the printer cable.

- Check that the cable is firmly connected at both ends.
- Many businesses use a switch box (sometimes called a T-switch) to share one printer between two computers. A printer cable connects to the printer port of each computer. The two cables connect to the switch box. A third cable connects from the switch box to the printer. A switch on the front of the box controls which computer has access to the printer. Switch boxes were built with older dot-matrix printers in mind. Some switch boxes are not recommended for ink-jet or laser printers that use a bidirectional parallel cable, and can even damage a printer. For these printers, remove the switch box.
- Try a different cable.
- Try printing using the same printer and printer cable, but a different PC.
- Enter CMOS setup of the PC and check how the parallel port is configured. Is it disabled? Set to ECP or bidirectional? Recall from Chapter 9 that an ECP parallel port requires the use of a DMA channel. Try setting the port to bidirectional.

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Problem with the OS or Device Drivers If the printer self-test worked, but the OS printer test did not work, the problem might be with the operating system or device drivers.

- Try rebooting and then print another OS test page.
- Try printing from DOS. Access a DOS prompt (real-mode DOS, not a DOS box) and print a directory list. Use the command **DIR > LPT1**. If nothing prints, press the Form Feed button. Sometimes a partial page needs to be ejected by this method before it prints when using DOS.
- If you can print from DOS, but not from Windows, try removing and reinstalling the printer driver. To uninstall the printer driver, right-click the printer icon in the Printers window, select **Delete** to remove the printer, and then reinstall the printer.
- Check the configuration of the parallel port in CMOS setup.
- Try another printer driver. It may not print graphics correctly, but if another driver does work at all, then you can conclude that you have a faulty driver. For example, if you have an HP LaserJet 5L, try using the HP LaserJet III driver.
- Verify printer properties. Try lowering the resolution or printing a different document.
- Try printing from NotePad. If you can print from NotePad, the problem is with the application. Reboot the PC and try to print from the application again.
- In the printer Properties dialog box, try disabling “Check Port State Before Printing.”
- Reboot the PC. Immediately print a text document in NotePad or WordPad.
- If you can print from DOS, but not from Windows, try disabling printer spooling. Go to the printer Properties dialog box and select **Print Directly to the Printer**. Spooling holds print jobs in a queue for printing, so if spooling is disabled, printing from an application can be slower.
- The print spool might be stalled. Try deleting all print jobs in the printer’s queue. Double-click the printer icon in the Printers window. Select **Printer, Purge Print Documents**.
- Also in the printer Properties dialog box, click **Disable bidirectional support for this printer**. The PC and printer might have a problem with bidirectional communication.
- Check the resources assigned to the printer port. Open **Device Manager**, select **LPT1**, and click **Properties**. Verify that the resources are assigned correctly for LPT1 (I/O addresses are 0378 to 037B) and that Device Manager reports “No conflicts.”

A⁺ OS 3.2 Problem with the Applications Software

- If you can print from NotePad or WordPad, but cannot print from another application, try closing and reopening the application.
- Verify that the correct printer is selected in the Print Setup dialog box. To set the printer as the default printer for Windows, using the Printer Window, right-click on the printer icon and select **Set as Default** from the shortcut menu.
- Try printing a different application file.
- Try creating new data in a new file and printing it. Keep the data simple.
- Try printing from another application.
- If you can print from other applications, but not this one application, consider reinstalling the application.

Sharing Printers over a Network

A⁺ OS 2.4, 4.1 Printers can be shared on a network using one of three basic methods.

- A regular printer can be attached to a PC using the PC's parallel port, and then that PC can share the printer with the network.
- A network printer with embedded logic to manage network communication can be connected directly to a network.
- A computer called a print server can control several printers connected to a network. For example, HP has software called HP JetDirect, designed to support HP printers in this manner.

This section explains how to make a printer connected directly to a PC available to the network and how to gain access to a shared printer on the network.

Print Services

Network print services allow a computer to share a printer connected to it, and to use printers that are connected to other computers on the network or connected directly to the network. In Windows 9x and Windows NT, you can share a printer as you share a file or folder: allow sharing and give the printer a name so that another user can identify the printer to the network. (Recall that if the remote user connects using a modem, you must also grant the right for the user to dial in.)

To Share a Printer To allow a remote PC to use a printer connected to a Windows 9x computer, do the following:

1. On the Windows 9x computer, make sure that File and Printer Sharing is installed. Click **Start**, point to **Settings**, click **Control Panel** and then double-click the **Network** icon.
2. If **File and Printer Sharing for Microsoft Networks** is not listed, click **Add** to install the component.

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3. Select **Service** and click **Add**. From the list of network services, select **File and Printer Sharing for Microsoft Networks** and click **OK**. You might be asked to insert the Windows 9x CD and to reboot the PC for the changes to take effect.

Once File and Printer Sharing is installed, share the printer by doing the following:

4. Click **Start**, point to **Settings**, and click **Printers**. The Printers window opens.
5. Right-click the printer you want to share. From the shortcut menu, select **Sharing**. (This Sharing option is grayed out if File and Printer Sharing is not installed.)
6. The Properties dialog box opens with the Sharing tab selected (see Figure 18-12).

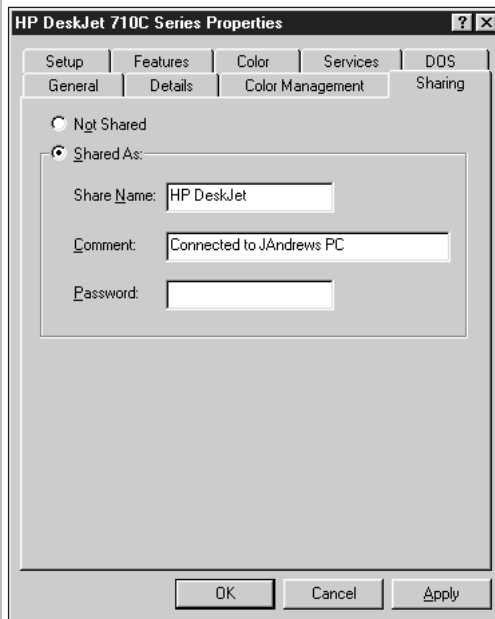


Figure 18-12 When using Windows 98, use the printer Properties window to share a connected printer with other computers on the network

7. Select **Shared As** and give the printer a **Share Name**. Click **OK** to exit.
8. The printer is listed in the Network Neighborhood group of other computers on the network.

To allow a remote PC to use a printer connected to a Windows NT workstation, do the following:

1. On the Windows NT PC, allow print sharing: click **Start**, point to **Settings**, and click **Printers**. The Printers window opens. Right-click the printer you want to share, and select **Sharing** from the shortcut menu. The printer Properties dialog box opens, as seen in Figure 18-13. Select **Shared** and enter a name for the printer. Click **OK** when done.

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2. The Windows NT PC must be connected to a network either directly or through RAS.

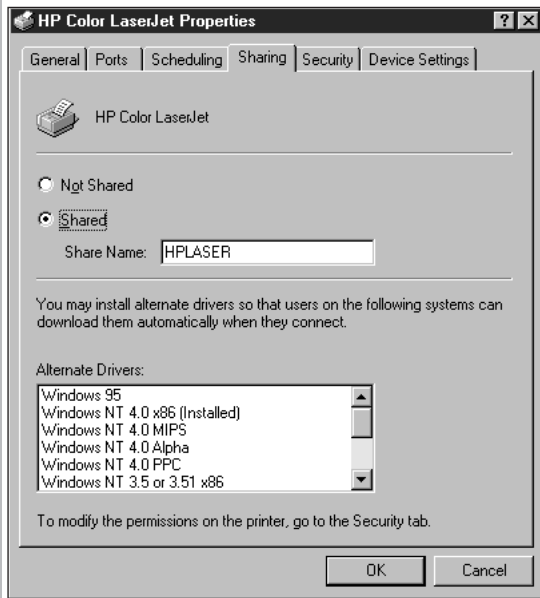


Figure 18-13 Windows NT printer sharing requires that you give the printer a name

To Use a Shared Printer On the Windows 9x local PC, follow these directions to use a shared printer on another PC:

1. Connect to the host computer by modem or by connecting directly to a LAN.
2. Add a new printer: click **Start**, point to **Settings**, and click **Printers**. Double-click **Add Printer**. The Add Printer Wizard window opens. Click **Next**.
3. In response to the question, “How is this printer attached to your computer?”, select **Network printer**. Click **Next**. The wizard window in Figure 18-14 opens.
4. Enter the host computer name and printer name. Begin with two backslashes and separate the computer name from the printer name with a backslash. Or you can click **Browse** and search the list of shared printers on the network, selecting the printer to install. If you plan to print from DOS applications, select yes to the question, “Do you print from MS-DOS based programs?” Click **Next**.
(If your network is using static IP addressing and you know the IP address of the host PC, you can enter the IP address instead of the host name in this step.)
5. Select the printer manufacturer and then the printer model from the list of supported printers. Click **Next** when finished.
6. Enter a name for the printer. You might include the location of the printer, such as 3rd Floor Laser or John’s Laser. Click **Next** to continue.
7. Print a test page, and then click **Finish**. The network printer is now available for use.

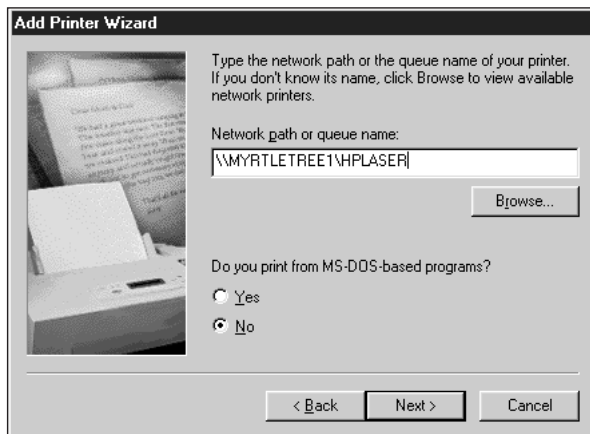


Figure 18-14 To use a network printer under Windows 9x, enter the host computer name followed by the printer name

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Problems with Network Printers If you are having problems with network printers, first rule out a physical problem with the printer. See guidelines on how to do that, earlier in this chapter. Problems with network printing can be caused by the printer, the network to the printer, or the computer trying to use the printer. You can isolate the problem by finding the answers to the following questions:

- Is the printer online?
- Is the network printer on the remote PC configured correctly?
- Is the correct network printer selected on the remote PC?
- Is there enough hard disk space available on the remote PC?
- Can you print successfully from another application on the remote PC?
- Can you print successfully from the host PC using the identical application?
- Can you print to a file and then send the file to the host PC to successfully print? If this works, then the problem is with data transmission. If this does not work, then the problem is with the application or print driver on the remote PC.
- For DOS applications, you may need to exit the application before printing occurs. Try capturing the printer port. To do that, go to the printer Properties window, click the Details tab, click Capture Printer Port and select the port. Type the network path and click OK. Under “Print to the following port,” select the port you mapped.

NOTEBOOK COMPUTERS

Supporting notebook computers is another essential task of a PC technician. This section discusses the special needs of supporting notebooks including adding memory to a notebook, changing power management options, understanding and supporting PC Cards, and using special Windows 98 components available for supporting notebooks.

Notebooks use the same technology as do PCs, but with modifications so as to use less voltage, take up less space, and work when on the move.

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A **notebook** or **laptop computer** is a computer designed for travel (see Figure 18-15). Notebooks use thin LCD panels instead of CRT monitors for display, compact hard drives that can withstand movement even during operation, and small memory modules and CPUs that require less voltage than regular components. Recall from Chapter 9 that notebook LCD panels use several different technologies, and that active matrix (sometimes called thin film transistor or TFT) technology generally gives better quality than does passive matrix (sometimes called dual-scan twisted nematic or DSTN) technology.

Notebooks cost more than PCs with similar features, because components are designed to be more compact and to endure movement and even jars when in use. The types and features of notebooks vary widely as they do for PCs. However, notebooks are generally purchased as a whole unit, including both hardware and software, and you are not likely to upgrade a notebook's hardware and OS, as you would with a PC. In fact, some notebook manufacturers no longer support a notebook that has had the OS upgraded or new hardware components added. In contrast, recall that PCs are highly modular, letting you easily interchange, upgrade, and enhance components. In fact, PCs are often assembled from components purchased from various vendors and manufacturers. Notebook computers, on the other hand, are designed with a different goal in mind and can be very proprietary in design, which means the skills needed to support them are brand-specific. In this chapter, we'll look at universal support issues, but remember that procedures can vary from one notebook brand to another.

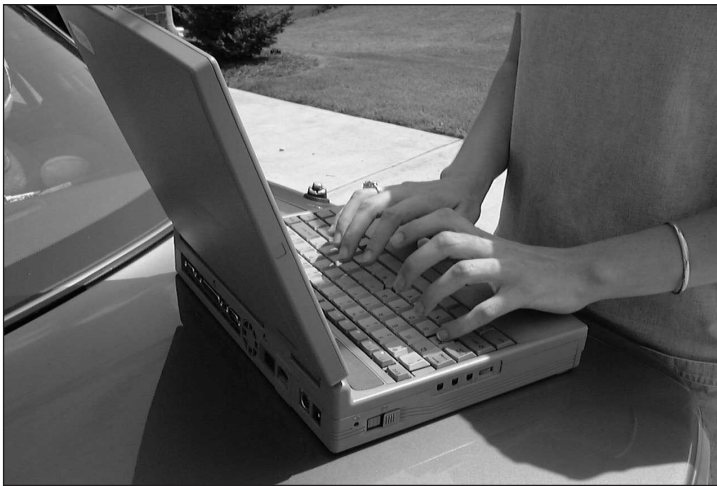


Figure 18-15 A notebook is a computer designed for travel

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The LCD panels on notebooks are fragile and can be damaged. Take precautions against damaging the notebook's LCD panel with rough use.

Windows 98 and Windows 2000 Professional offer features designed specifically for notebooks, and these are covered as well as managing power, upgrading memory, adding peripheral devices, and supporting PC Cards.

When supporting any notebook, pay careful attention to the stipulations on the warranty that accompanies it. Some warranties are voided if you open the notebook case or install memory, batteries, or a hard drive that was not made by, or at least authorized by, the notebook manufacturer. Almost all operating system installations on notebooks are customized by the manufacturer, and a floppy disk comes with the notebook that contains data and utilities specific to the configuration. Read the supporting documentation for the notebook before you consider upgrading or reinstalling the OS.

Windows 98 Notebook Features

The Windows 98 features designed to support notebooks include:

- Multilink Channel Aggregation, a feature that allows you to use two modem connections at the same time to speed up data throughput when connected over phone lines. It works on both regular analog phone lines and ISDN. To use the feature, you must have two phone lines and two modem cards that are physically designed to connect two phone lines at the same time. You will learn more about PC Card modems later in the chapter.
- **ACPI (Advanced Configuration and Power Interface)** developed by Intel, Microsoft, and Toshiba to control power on a notebook and other devices. ACPI allows a device to turn on a notebook or allows a notebook to turn on a device. For example, if you connect an external CD-ROM drive to the notebook, it can turn on the notebook, or the notebook can cycle up and turn on an external CD-ROM drive. The BIOS of the notebook and the device must support ACPI for it to work.
- Several improvements over Windows 95 for managing power consumption for notebooks. Windows 98 automatically powers down a PC Card modem when not in use, supports multiple battery packs, and lets you create individual power profiles. Power profiles are described in the next section.
- Improved support for PC Cards, adding several new drivers.
- Microsoft Exchange lets a user select what e-mail to download when traveling with a notebook. Downloading large e-mail messages with attachments takes a long time over a modem. You might prefer to leave this e-mail to download when you are later connected directly to the network.



When returning from a trip with a notebook, you might want to update your desktop PC with all e-mail documents and other files created or updated during the trip. To do this, use Windows 9x **Briefcase**, a system folder used to synchronize files between two computers. Briefcase automatically updates files on the original computer to the most recent version. You can use a null modem cable, disk, or network for the file transfer.

Power Management

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A notebook can be powered by a battery pack or an AC adapter connected to a power source. The length of time that a battery pack can power the notebook before being recharged varies according to the quality of the battery, the power consumption as determined by the devices being used, and how power is being managed.

Windows 98 has features to help manage power consumption. The goal is to minimize power consumption to increase the time before a battery pack needs recharging. Using Windows 98, to access the power management window, click **Start**, point to **Settings**, click **Control Panel** and double-click the **Power Management** icon. Figure 18-16 shows the Power Management Properties dialog box for one notebook. (Other brands of notebooks may have different tabs in their Properties dialog box.) Use this dialog box to create, delete, and modify multiple power management schemes to customize how Windows 98 manages power consumption.

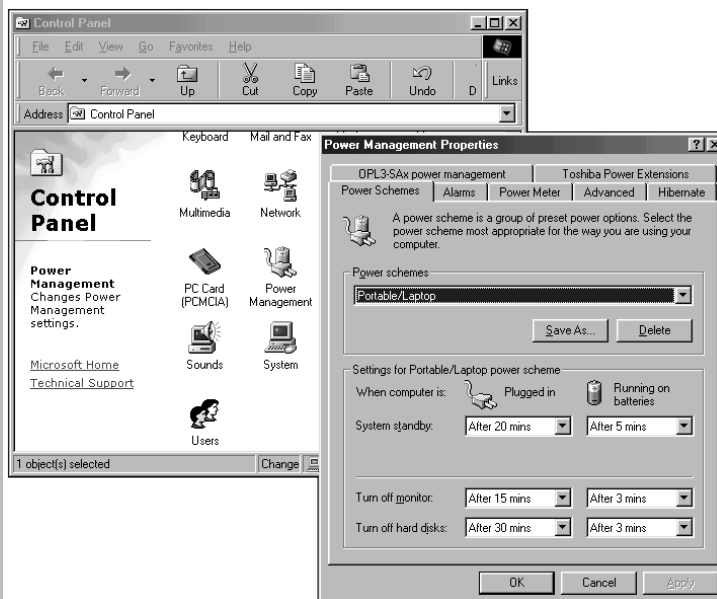


Figure 18-16 The Power Management Properties box of Windows 98 allows you to create and manage multiple power schemes

For example, one power-saving feature of Windows 98 puts a notebook into **hibernation**. When a computer hibernates, it stores whatever is currently in memory and then shuts down. When it returns from hibernating, it restores everything to the way it was before the shutdown. When hibernating, the notebook is not using power. When you step away from the notebook for a few minutes and direct the notebook to hibernate, you save power.

To configure Windows 98 to cause the notebook to hibernate when you close the lid of the notebook, do the following:

1. In the Power Management Properties dialog box, click the **Hibernate** tab (see Figure 18-17) and verify that hibernate support is enabled.

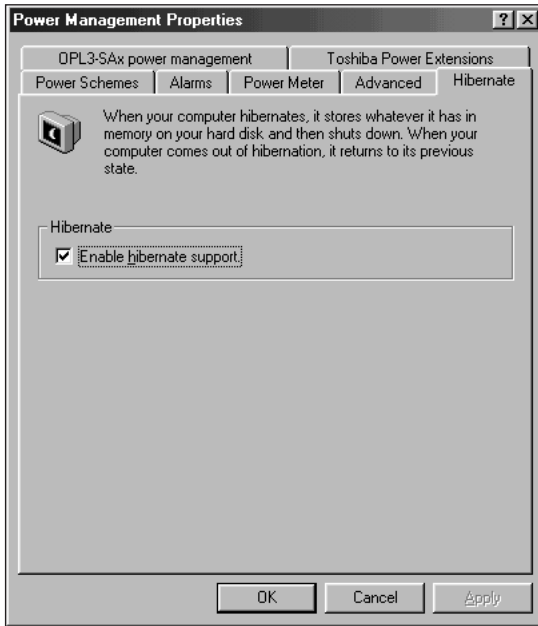


Figure 18-17 Verify that hibernate support is enabled

2. Click the **Advanced** tab. Figure 18-18 shows the Advanced page which you use to control what happens when you press the shut down button or close the lid of the notebook.
3. Click the list arrow for “When I close the lid of my portable computer” and select **Hibernate**. See Figure 18-19.
4. Click **Apply** and **OK** to close the Properties dialog box, saving your changes.

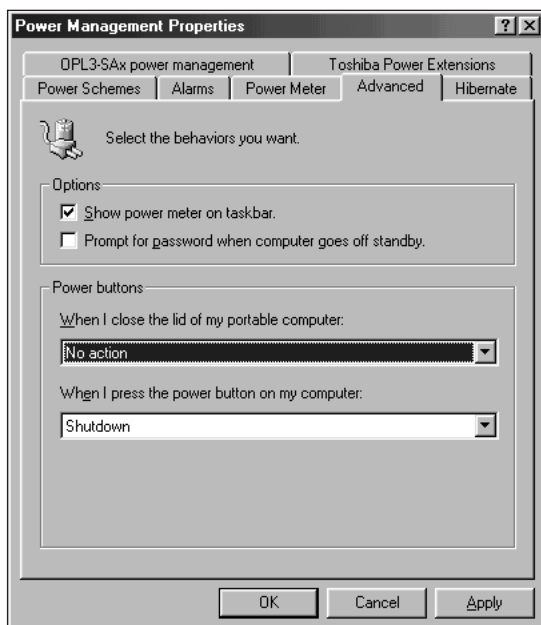


Figure 18-18 The Advanced tab of Power Management allows you to control the behavior of the power button and what happens when you close the lid of your notebook

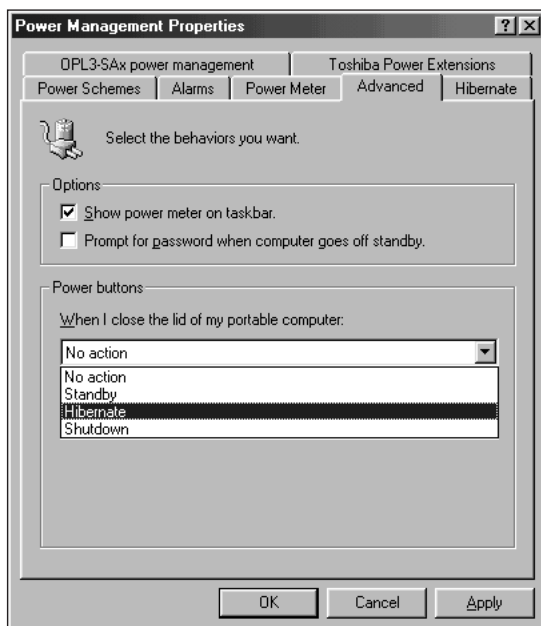


Figure 18-19 Choices of action when you close the lid of your notebook

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If you need to use the notebook for extended periods away from an electrical outlet, you can use extra battery packs. When the notebook signals that power is low, remove the old battery and replace it with a charged one. See the notebook user guide for directions. Here is an example of directions for exchanging the battery pack for one notebook:

1. Save your work and turn off the notebook.
2. Remove all cables connected to the notebook.
3. Set the notebook on its back, as in Figure 18-20.

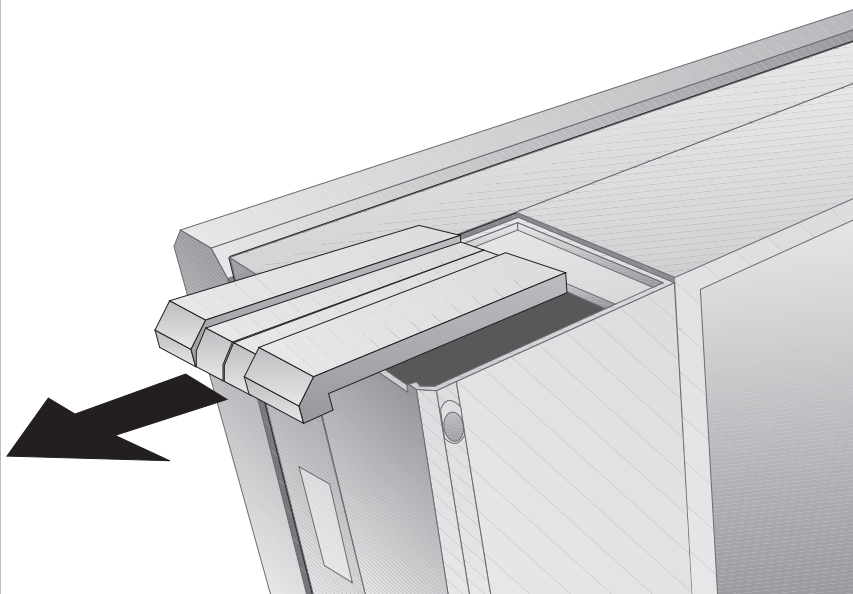


Figure 18-20 Slide the battery release panel to the left to expose the battery pack

4. Slide the battery release panel to the left to expose the battery.
5. Lift the battery out of the computer.
6. Before placing a new battery in the slot, clean the edge connectors of the battery with a clean cloth.

Windows 2000 Notebook Features

Windows 2000 Professional has several new features designed to support notebooks. When choosing between Windows 98 and Windows 2000 Professional for a notebook OS, use Windows 98 for low-end notebooks and Windows 2000 for high-end notebooks that are used in a business environment in which security is important. Windows 2000 has stronger power management and security features. The features new to Windows 2000 include:

- **Offline Files**, which replaces Briefcase, stores shared network files and folders in a cache on the notebook hard drive so you can use them offline. When you

reconnect to the network, Offline Files synchronizes the files in the cache with those on the network.

- Hibernate mode, support for ACPI and APM (Advanced Power Management) have been improved.
- Improved battery support includes the ability to use two batteries and to monitor battery performance with greater control.
- Hot swapping of IDE devices and floppy disk external drives is a new feature.
- Folder redirection lets you point to an alternate location on a network for a folder. This feature can make the location of a folder transparent to the user.

Upgrading Memory

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Notebooks use proprietary (built by the manufacturer of the notebook) memory modules that are smaller than regular SIMMs or DIMMs called **SO-DIMMs** (small outline DIMMs), which have 72 pins and support 32-bit data transfers (see Figure 18-21). Before upgrading memory, make sure you are not voiding your warranty. Search for the best buy, but make sure you use memory modules made by the notebook manufacturer and designed for the exact model of your notebook. Installing generic memory might save you money, but might also void the warranty of the notebook.

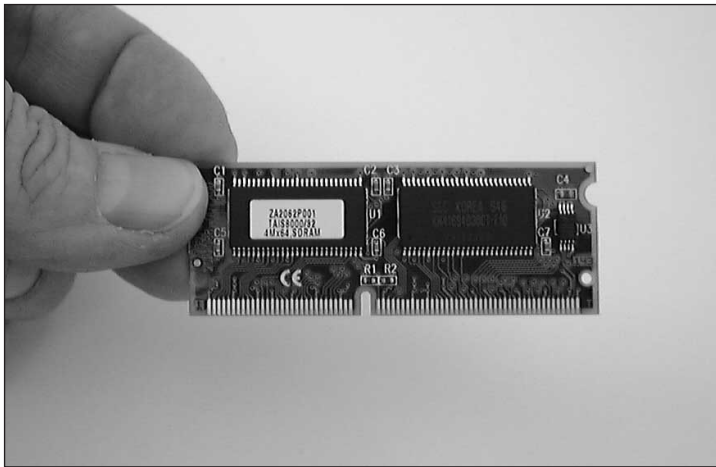


Figure 18-21 An SO-DIMM memory module for a notebook computer

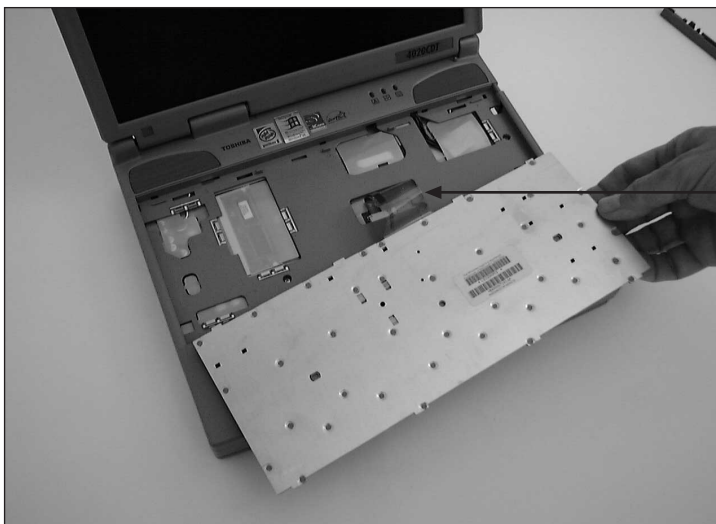
To install memory, see the notebook user guide for directions. The following is an example of how to install memory on one notebook. Directions vary from one computer to another.

1. Turn off the notebook and remove all cables.
2. Lift the keyboard brace, as shown in Figure 18-22.



Figure 18-22 Lift the keyboard brace

3. Turn the keyboard over and toward the front of the notebook. See Figure 18-23. The keyboard is still connected to the notebook by the ribbon cable.



Ribbon cable connecting
keyboard to notebook

Figure 18-23 Turn the keyboard over toward the front of the notebook to expose memory module sockets

4. Lift up the plastic sheet covering the memory module socket.

5. Insert the SO-DIMM module into the socket. See Figure 18-24. The socket braces should snap into place on each side of the module when the module is in position.

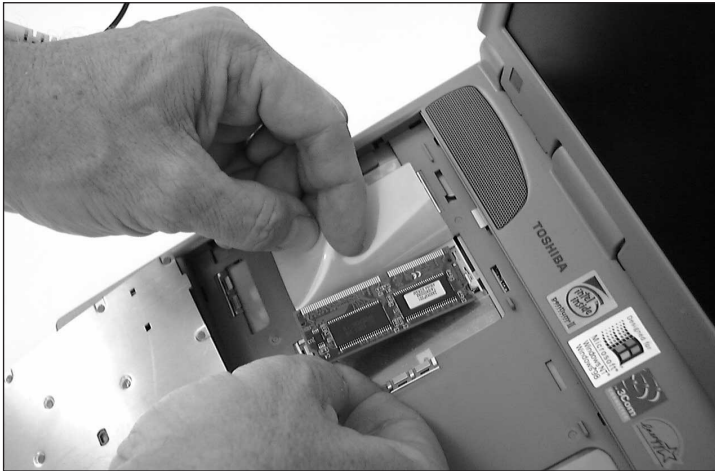


Figure 18-24 Install the SO-DIMM into the memory socket

6. Replace the keyboard and keyboard brace.
7. When you power up the notebook, it detects the new memory.

Connecting Peripheral Devices to Notebooks

A⁺CORE 1.3, 1.7 A notebook provides ports on its back or sides (see Figure 18-25). With the exception of the infrared port, all these ports have been discussed in earlier chapters. An infrared port connects devices to notebooks or other computers without cabling. A printer, keyboard, microphone, mouse, or other device can communicate with the laptop by using an infrared signal over a short distance. With special software, the notebook can communicate with another computer using the infrared port. Windows 98 and Windows 2000 support infrared devices. To activate an infrared device, double-click the Infrared icon in Control Panel. The most popular way to add peripheral devices to a notebook is by using PC Card slots.

A⁺CORE 1.2, 4.3 PC Cards (PCMCIA Cards)

Unlike PCs, notebooks don't have the traditional expansion slots that connect to an I/O bus to add peripheral devices to a system. Rather, notebook computers contain special bus expansion slots called **PC Card slots** (see Figure 18-26), formally called **PCMCIA slots**, that connect to the 16-bit PCMCIA I/O bus on the notebook system board.

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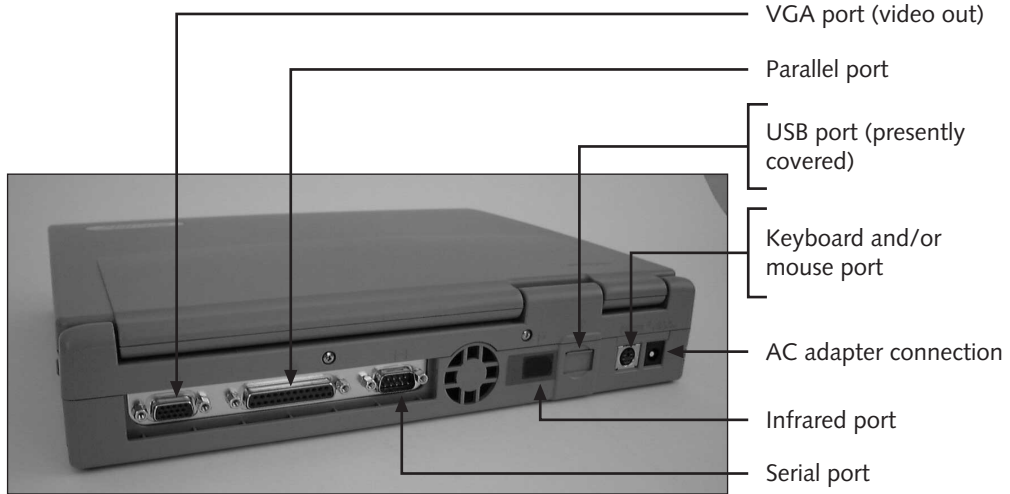


Figure 18-25 Ports on the back of a notebook



Figure 18-26 Most peripheral devices are added to a notebook using a PC Card slot; here, a modem PC Card is inserted in a PC Card slot

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The PCMCIA organization (Personal Computer Memory Card International Association) has developed four standards for these slots. Once intended only for memory cards (cards that add additional memory to a notebook), these PC Card slots can now be used by many devices, including modems, network cards, CD-ROMs, sound cards, and hard disks. Some docking station PCs also have a PC Card slot, so that the device you use with your notebook can also be attached to the docking station. (A **docking station** or port replicator such as the one shown in Figure 18-27 is a special device that allows a notebook to easily connect to a full-sized monitor, keyboard, and other peripheral devices.) The latest PCMCIA specification is called

A+CORE CardBus and improves I/O speed, increases the bus width to 32 bits, and supports lower-voltage PC Cards while maintaining backward compatibility with earlier standards.
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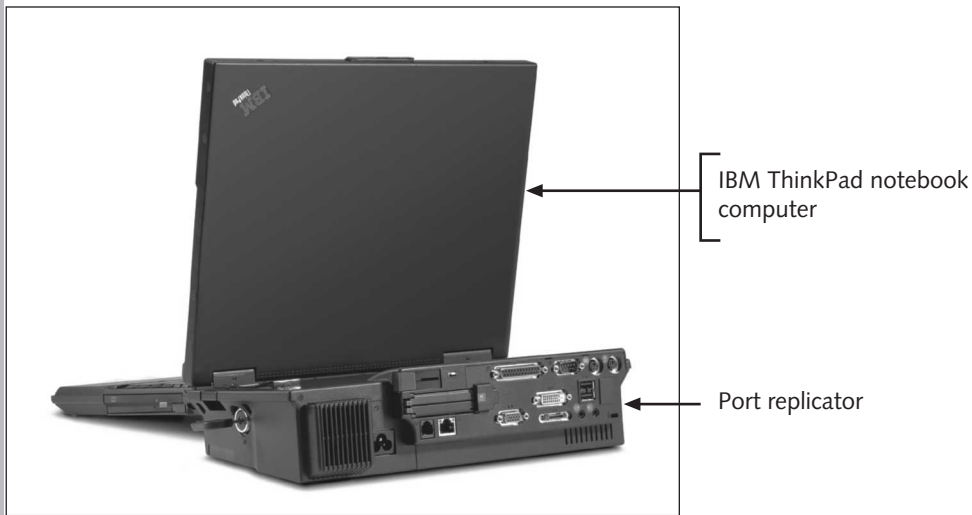


Figure 18-27 A docking station or port replicator makes it convenient to connect a notebook computer to resources and peripherals at your office

A+CORE Three standards for the PCMCIA slots pertain to size and are named Type I, Type II, and Type III. Generally, the thicker the PC Card, the higher the standard. A thick hard drive card might need a Type III slot, but a thin modem card might only need a Type II slot. The PC Card is about the size of a credit card, but thicker, and inserts into the PC Card slot. Type I cards can be up to 3.3-mm thick and are primarily used for adding RAM to a notebook PC. Type II cards can be up to 5.5-mm thick and are often used as modem cards. Type III cards can be up to 10.5-mm thick, which is large enough to accommodate a portable disk drive. When buying a notebook PC, look for both Type II and Type III PC Card slots. Often one of each is included. For improved performance, look for the slots to be 32-bit CardBus slots.

The operating system must provide two services for the PC Card, a socket service and a card service. The socket service manages the socket, closing (establishing) the socket when the card is inserted and opening (disconnecting) the socket when the card is removed. The card service provides the device driver to interface with the card once the socket is closed.

The PC Card might contain a data cable to an external device, or it might be self-contained. For example, in Figure 18-28, the PC Card on the left is the interface between the notebook PC and the CD-ROM external drive. Insert the PC Card in the PC Card slot. The data cable from the PC Card connects to the external CD-ROM drive, which requires its own power supply that must be connected into a wall outlet. On the other hand, the PC Card on the right in Figure 18-28, is the actual modem. Insert the card in the PC Card slot (Figure 18-27) and connect the telephone line to the modem PC Card (Figure 18-29).

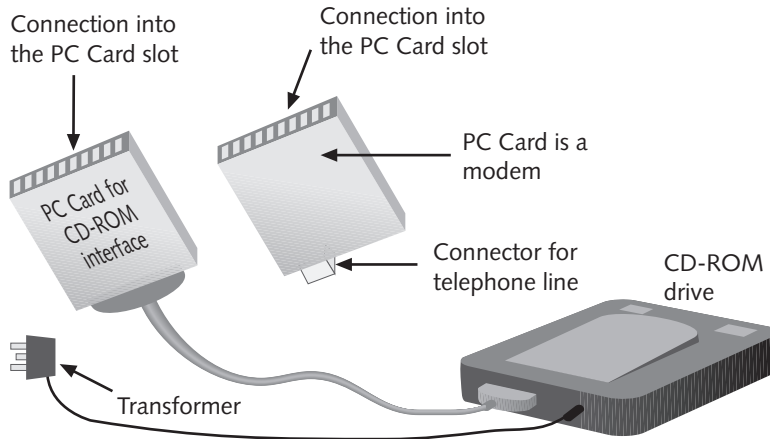


Figure 18-28 Two examples of PC Cards, one self-contained (the modem), the other connected to an external device (the CD-ROM)

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One worthwhile feature in PC Card slots is **hot swapping** (which means you can install a device while a computer is running, and the computer will recognize the device without having to reboot). Hot swapping allows you to remove one card and insert another without powering down the PC. For example, if you are currently using a modem card in the PC Card slot and want to switch to the CD-ROM, first turn off the modem card (open the socket) by using the PC Card icon in the Windows 9x Control Panel (see Figure 18-30). Then remove the modem card and insert the CD-ROM card with the attached external CD-ROM drive.

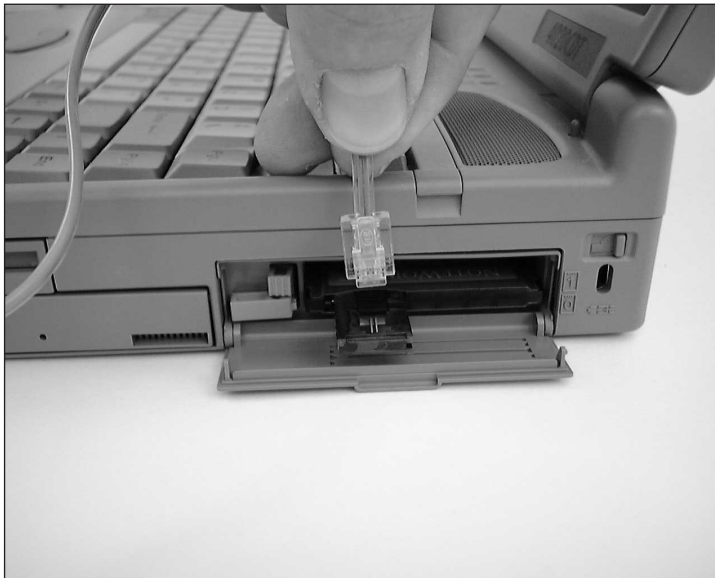


Figure 18-29 Connect the phone line to the modem PC Card

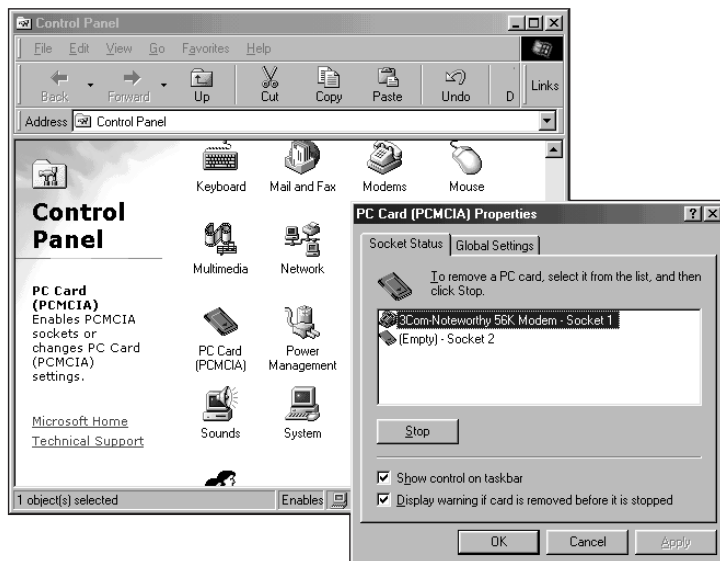


Figure 18-30 Before removing a PC Card from the notebook, stop the Card (open the socket) from the PC Card Properties box

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Another popular use of a PC Card is to interface with a network. Figure 18-31 shows a PC Card that serves as the NIC to an Ethernet 10BaseT network. The RJ-45 connection is at the end of a small cord connected to the PC Card. This small cord is called a dongle or pigtail, and is used so that the thick RJ-45 connection does not have to fit flat against the PC Card.

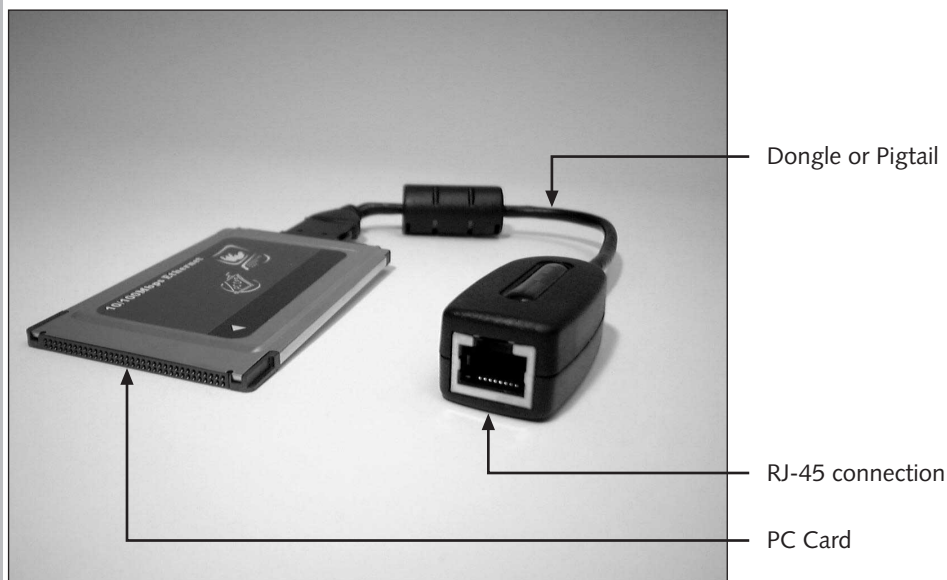


Figure 18-31 This PC Card serves as a NIC for an Ethernet 100BaseT network

Supporting Notebooks

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Except for the differences discussed in this section, notebooks work identically to desktop PCs, and the troubleshooting guidelines in previous chapters also apply to notebooks. When troubleshooting notebooks, be especially conscious of warranty issues; know what you can do within the guidelines of the warranty. The documentation that comes with a notebook is much more comprehensive than what comes with a PC and most often contains troubleshooting guidelines for the notebook. Remember that the loaded OS and the hardware configuration are specific to the notebook, so you can rely on the notebook manufacturer for support more than you can for a desktop PC. Sometimes a notebook is designed so that the hard drive can be replaced or upgraded without violating warranties. See the notebook documentation for details. For questions about supporting a notebook that are not answered in the documentation, see the web site of the notebook manufacturer. Popular manufacturers of notebooks and their web sites are listed in Table 18-1.

Table 18-1 Notebook manufacturers

Manufacturer	Web Site
Acer America	www.acer.com
ARM Computer	www.armcomputer.com
Compaq Computer	www.compaq.com
Dell Computer	www.dell.com
FutureTech Systems	www.futuretec.com
Gateway	www.gateway.com
Hewlett-Packard	www.hp.com
IBM	www.ibm.com
Micron Electronics	www.micronpc.com
PC Notebook	www.pcnotebook.com
Sony	www.vaiodirect.sel.sony.com
Toshiba America	www.csd.toshiba.com
WinBook	www.winbook.com

Personal Digital Assistant (PDA)

A **personal digital assistant (PDA)** such as a Palm Pilot or a Pocket PC is a small handheld computer that has its own operating system and applications. You can use a PDA to store addresses and phone numbers, manage a calendar, run word processing, send e-mail, access web sites, play music, and exchange information with a desktop computer. A PDA most likely uses either the Palm operating system for Palm Pilot devices or Microsoft Windows CE. Some PDAs come with all application software preinstalled and others require the user to download applications at additional cost. Some PDAs allow you to download e-mail or web site content from a desktop computer or a notebook, and others can access the Internet directly by way of a modem or wireless connection. Not all web sites are designed to be

accessed by a PDA and the web content readable by a PDA is more limited than that readable by a desktop computer or notebook.

Typically, a PDA comes with a cable to connect to a desktop computer or notebook by way of a serial or USB port, or a PDA might use an infrared connection. Special software such as ActiveSync by Microsoft might be needed to perform the synchronization. Similar to a notebook, a PDA is battery powered, uses either a grayscale or color active matrix or dual scan passive matrix display, and can sometimes benefit from additional memory.

CHAPTER SUMMARY

Printers

- The three most popular printers are dot-matrix, ink-jet, and laser. Laser printers produce the highest quality, followed by ink-jet printers. Dot-matrix printers have the advantage of printing multicopy documents.
- The six stages that a laser printer uses to print are cleaning, conditioning, writing, developing, transferring, and fusing. The first four stages are performed inside the removable toner cartridge.
- Ink-jet printers print by shooting ionized ink at a sheet of paper.
- The nozzles of an ink-jet printer tend to clog, especially when the printer remains unused. The nozzles can be cleaned automatically through printer software or by buttons on the front panel of the printer.
- Dot-matrix printers print by projecting pins from the print head against an inked ribbon that deposits ink on the paper.
- When troubleshooting printers, first isolate the problem. Narrow the source to the printer, cable, PC hardware, operating system including the device driver, applications software, or network.
- When computers are connected with a modem or a network, printers can be shared among computers.
- A printer can be shared on a network in three ways: as a regular printer connected to a PC's parallel port, serial port, USB port, or 1394 port (access to this printer is by way of the PC it's connected to), as a network printer connected directly to the network, or as a printer controlled by a print server.
- When a printer is connected to a PC port, install File and Printer sharing to share that printer using Windows 9x. The person using the PC connected to the printer must name the shared printer. This name, together with the computer name, identifies the printer on the network.

Notebook Computers

- A notebook is a computer designed for travel. Notebooks cost more than comparable PCs because they are more compact and can withstand movement and jars even when in use. Notebooks don't contain expansion slots for I/O devices, but rather use PC Card slots.
- Windows 98 offers several features to support notebooks, including using multiple modems for faster data transmission, ACPI and other power management features, improved support for PC Cards, and improved e-mail services.
- Use hibernation to manage power consumption on notebooks. With hibernation, the notebook takes a "snapshot" of the open applications before it shuts down and then returns you to that same state after a power-up.
- Notebooks use a memory module called a SO-DIMM, which is smaller than a regular SIMM or DIMM.
- Upgrading memory on a notebook varies from one notebook to another, so see the user guide for a notebook for specific instructions.
- When upgrading components on a notebook, including memory, use the same brand of components as the notebook, or only use components recommended by the notebook manufacturer.
- PC Cards are a popular way to add peripheral devices to notebooks. There are three types of PC Cards, which vary in thickness: Types I, II, and III.

KEY TERMS

ACPI (Advanced Configuration and Power Interface) — Specification developed by Intel, Microsoft, and Toshiba to control power on notebooks and other devices. Windows 98 supports ACPI.

Beam detect mirror — Detects the initial presence of a laser printer's laser beam by reflecting the beam to an optical fiber.

Briefcase — A Windows 9x system folder used to synchronize files between two computers. When files are transferred from one computer to another, Briefcase automatically updates files on the original computer to the most recent version.

Control blade — A laser printer component that prevents too much toner from sticking to the cylinder surface.

Docking station — A device designed to connect to a portable, or notebook, computer to make it easy to connect the notebook to peripheral devices.

Enhanced metafile format (EMF) — A format used to print a document that contains embedded print commands. When printing in Windows, EMF information is generated by the GDI portion of the Windows kernel.

Hibernation — A power-saving notebook feature. When a computer hibernates, it stores whatever is currently in memory and then shuts down. When it returns from hibernating, it restores everything back to the way it was before the shutdown.

Hot swapping — The ability of a computer to use a device, such as a PC Card on a notebook, that is inserted while the computer is running without the computer needing to be rebooted.

Laptop computer — See Notebook.

Notebook — A personal computer designed for travel, using less voltage and taking up less space than a regular PC. Also called a laptop computer.

PC Card — A credit-card-sized adapter card that can be slid into a slot in the side of many notebook computers and is used for connecting to modems, networks, and CD-ROM drives. Also called PCMCIA Card.

PC Card slot — An expansion slot on a notebook computer, into which a PC Card is inserted. Also called a PCMCIA Card slot.

PCMCIA (Personal Computer Memory Card International Association) card — See PC Card.

PCMCIA Card slot — See PC Card slot.

RET (resolution enhancement technology) — The term used by Hewlett-Packard to describe the way a laser printer varies the size of the dots used to create an image. This technology partly accounts for the sharp, clear image created by a laser printer.

Scanning mirror — A component of a laser printer. An octagonal mirror that can be directed in a sweeping motion to cover the entire length of a laser printer drum.

SO-DIMM (small outline DIMM) — A small memory module designed for notebooks that have 72 pins and support 32-bit data transfers.

Spooling — Placing print jobs in a print queue so that an application can be released from the printing process before printing is completed. Spooling is an acronym for simultaneous peripheral operations online.

Toner cavity — A container filled with toner in a laser printer. The black resin toner is used to form the printed image on paper.

REVIEW QUESTIONS

1. List the six steps used by a laser printer to print a page.
2. Which document exhibits better quality, one printed with 300 dpi or one printed with 600 dpi? Why?
3. During the laser printing process, what determines when the toner sticks to the drum and when it does not stick to the drum?
4. Why is it less expensive to maintain an ink-jet printer that has a black ink cartridge than one that does not?
5. What technology makes an ink-jet printer a photo-quality ink-jet printer?
6. What should you do if an ink-jet printer prints with missing dots or lines on the page?
7. What should you do if an ink-jet printer prints with ink streaks on the page?
8. What can you do to help a dot-matrix printer last longer?
9. When you are isolating a printer problem, what are the four major possible sources of the problem?

10. How can you eliminate the printer as the source of a printing problem?
11. If you can print a test page from the operating system successfully, then what is the likely source of a printer problem?
12. How can you be sure that a printer cable is not the source of a printer problem?
13. What are two possible settings in CMOS for parallel port mode?
14. List two possible ways to improve printing speed.
15. When a laser printer is short on memory, what is a possible symptom of this problem?
16. Why are notebooks usually more expensive than PCs with comparable power and features?
17. What type of memory module is used in a notebook?
18. How are battery packs used in a notebook?
19. What type of monitor does a notebook use?
20. When a battery pack discharges and you need to continue working on a notebook, what are your two choices?
21. What is the thickness of a Type I PC Card? Of a Type III PC Card?
22. What term refers to a PC Card you can remove and replace without powering off?
23. What two services must an OS provide for a PC Card to work?
24. What is the small cord sometimes found on the end of a PC Card called?

PROJECTS



Installing a Printer

Practice installing a printer by uninstalling a printer and then reinstalling it. If the printer is not supported by your OS, you will need the CD or disk that contains the driver software.



Research Printer 1394 Connections

Your company wants to improve the printing speed on its network and has asked you to do some research on the Internet. You are considering using IEEE 1394 for your printer connection to a PC that currently does not have a 1394 port. Research the Unibrain web site (www.unibrain.com) and provide the following:

1. Print the web page of a card that can be installed in a PC to provide a 1394 port for a printer.
2. Print the web page of a card that can be installed in a printer to provide the 1394 connection.
3. Research a printer manufacturer web site (for example, HP at www.hp.com), and print the web page for a printer that can support this 1394 connection.



Troubleshooting Skills

Practice troubleshooting skills by doing the following. Begin with a printer connected to a PC that is printing properly.

1. Turn off spooling to the printer. Print several files from an application. What difference do you see between spooling and not spooling the documents?
2. In CMOS setup, disable the parallel port being used by the printer. What happens when you attempt to print?
3. In CMOS setup, change the mode of the parallel port. Try printing a document with each mode selected. What happens when you attempt to print using each mode?



Printer Maintenance

For an ink-jet printer, follow the procedures in the printer's user guide to clean the printer nozzles and ink cartridges. For a laser printer, follow the procedures in its user guide to clean the inside of the printer where the toner cartridge is installed.



Power Management Features of a Notebook

Using a notebook, change the power management options to support hibernation. If the notebook supports it, set hibernation to start when the notebook lid is closed. Open one or more applications that include current data on the screen. Close the lid or, if that is not supported, wait the specified time until hibernation begins. Start up the notebook again (you can use the power on switch) and verify that applications and data are restored to their status when hibernation began.



Notebook Batteries

Practice replacing a dead battery on a notebook by removing and replacing the battery. Using the model number on the battery, find out the current price of a new battery unit. See the Web site of the notebook manufacturer for this information.



Research PC Card Modems

Some employees in your company spend much time on the road and, while traveling, need easy access to the Internet. Research how they could use a cellular phone to connect a notebook computer to the Internet. Using the Motorola web site (www.motorola.com) or a similar site, provide the following:

1. Print the web page of a modem card for a notebook computer that can accommodate a cellular phone connection.
2. Print the web page of a cellular phone that can accommodate a modem card connection to a notebook.
3. Print the page that shows or describes the cord that connects the modem card to the cellular phone.